27 Aug 01

DEPARTMENT OF THE AIR FORCE
Aerospace Basic Course (AETC)
Maxwell Air Force Base, Alabama 36112

LESSON PLAN

A1210, AIR AND SPACE SYSTEMS AND CAPABILITIES

CONTENTS

RECORD OF CHANGES

CHANGE NUMBER	REMARKS
New Lesson Plan	Supercedes ABC lesson 1110 dated 7 Aug 00

SUMMARY OF CHANGES

EDUCATIONAL GOALS

A1000 Area Objective: Apply aerospace power capabilities and officership principles to warfighting.

A1200 Phase Objective: Comprehend how the proper employment of aerospace systems enhances warfighting.

A1210 - AIR AND SPACE SYSTEMS AND CAPABILITIES

Lesson Objective 1: Know selected current air and space systems.

Samples of Behavior:

(R/S) 1.1 - Identify pictures or descriptions of air and space systems by name and designator.

Lesson Objective 2: Know the capabilities and limitations of selected current air and space systems.

Samples of Behavior:

(R/S) 2.1 - List the capabilities of selected current air and space systems.

(R/S) 2.2 - List the limitations of selected current air and space systems.

Lesson Description: In this lesson, students will learn the current US air and space order of battle and the capabilities and limitations of each system.

Prerequisites: None

Preparation: Read A1210, Air and Space Systems and Capabilities.

Optional: N/A

Rationale/Linkage: The A1200 Phase of instruction focuses on proper employment of aerospace systems to achieve desired effects. In this lesson, students learn not only about individual systems' capabilities, but also about their limitations. In A1220, Air and Space Power Functions, students learn about the broad, fundamental, and continuing activities of air and space power

that comprise the Air Force's basic functions, according to AFDD 1. Lesson A1230, Force Packaging, integrates the information of A1210 and A1220: In A1230, students learn that we can best accomplish the functions of air and space power when different air and space systems work together, thereby achieving synergy. Students learn how we assemble force packages to maximize the benefit gained by each system's capabilities and minimize the liabilities of each system's limitations. These lessons prepare students for A1250, Air Force Employment Exercise (AFEX), as well as for the A1300 Phase of instruction on the Air Force Core Competencies, and the A1700 Phase--Blue Thunder.

INSTRUCTIONAL PLAN

1. **TITLE AND LENGTH OF SEMINAR:** Air and Space Systems and Capabilities (1:30)

2. **RELATION TO OTHER INSTRUCTION:** The A1200 Phase of instruction focuses on proper employment of aerospace systems to achieve desired effects. In this lesson, students learn not only about individual systems' capabilities, but also about their limitations. In A1220, Air and Space Power Functions, students learn about the broad, fundamental, and continuing activities of air and space power that comprise the Air Force's basic functions, according to AFDD 1. Lesson A1230, Force Packaging, integrates the information of A1210 and A1220: In A1230, students learn that we can best accomplish the functions of air and space power when different air and space systems work together, thereby achieving synergy. Students learn how we assemble force packages to maximize the benefit gained by each system's capabilities and minimize the liabilities of each system's limitations. These lessons prepare students for A1250, Air Force Employment Exercise (AFEX), as well as for the A1300 Phase of instruction on the Air Force Core Competencies, and the A1700 Phase--Blue Thunder.

3. **GENERAL METHOD OF INSTRUCTION:**

   a. Presentation Method: Guided discussion

   b. Time Outline:

Segment Time	Total Time	Description
0:05	(0:05)	Introduction
0:25	(0:30)	MP I: Satellites
0:10	(0:40)	MP II: Launch Vehicles and Ballistic Missiles
0:45	(1:25)	MP III: Aircraft
0:05	(1:30)	Conclusion

   c. Instructor Preparation:

   - Review the lesson plan.
   - Read A1210, Air and Space Systems and Capabilities.

d. Instructional Aids/Handouts:

- Slides
- Video Clips: AF Videos, "Space Operations"
- Video Clips: AF Videos, "Airpower Demos"

e. Student Preparation:

- Read A1210, Air and Space Systems and Capabilities.

f. Strategy: This lesson is a guided discussion. Since this lesson covers a great deal of information, the instructor should respond to students' needs by spending more time on systems the students are less familiar with. In addition, capitalize on students' knowledge, background, and experiences: The instructor may wish to appoint individual students to deliver an impromptu briefing on particular systems, especially if certain students have specialized knowledge of the systems. This will gain students' interest and personal "buy-in" to the class discussion. As chief facilitator of the entire discussion, the instructor must keep an eye on the clock and be sure students discuss all of the systems in enough detail so that students can approach A1250, Air Force Employment Exercise (AFEX) with confidence.

g. References: N/A

4. **DETAILS OF INSTRUCTION**:

[SLIDE]

a. Introduction: 0:05 (0:05)

1) //Attention//

Let's say you're at an airshow--in uniform--and you step inside a hangar to check out the displays. A troop of Girl Scouts and Boy Scouts are looking at one of the displays. They spot you and are immediately won over by your sharp uniform and military bearing. Confident you know everything about the Air Force, they point to this picture and ask, "What's this?"

[SLIDE]

2) //Motivation//

You'd better know the answer! (By the way, this is the RQ-1A "Predator" medium-altitude, long-endurance unmanned aerial vehicle system, to be exact.) Each of us represents the world's greatest aerospace force, so we should be familiar with the air and space systems we employ.

3) //Overview//

Let's talk about these systems. I'd like to see how much you know without referring to the reading, but as we talk about them, feel free to take notes in your book. We'll try to cover everything in the reading, but we'll spend more time discussing the systems which are less familiar to most of you.

*{**Instructor Note:** Throughout the lesson, you can either ask the questions as written, or show the students photographs of the systems, and ask students to identify them.}*

b. MP I: Satellites: 0:25 (0:30)

*{**Instructor Note:** Throughout this main point, you can show students selections of the "Space Operations" videos (available on the LAN) to demonstrate these systems.}*

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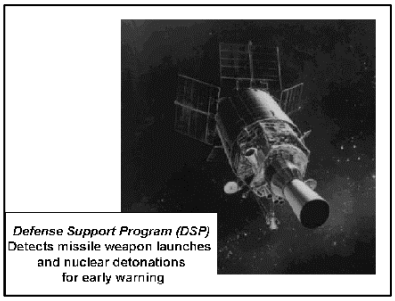


LEAD OFF QUESTION (LOQ): WHAT DOES "DSP" STAND FOR? DESCRIBE THE SATELLITE. WHAT CAN IT DO?

ANTICIPATED RESPONSES (AR):

- Defense Support Program
- Telescope-shaped shield covering the infrared sensor equipment
- Can detect space orbit launches, missile weapon launches, and nuclear detonations for early warning

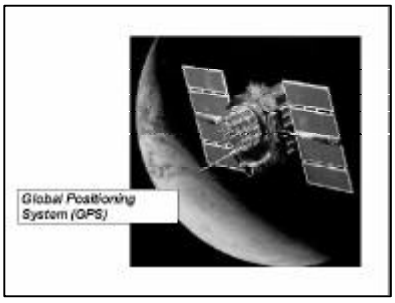
[SLIDE]

LOQ: WHAT DOES "DMSP" STAND FOR? DESCRIBE THE SATELLITE. WHAT CAN IT DO?

AR:

- Defense Meteorological Satellite Program
- 1 long, rectangular solar panel
- Provides high-resolution visual & infrared imagery of cloud cover
- Passes over each ground point in their orbit at the same local solar time each day (sun synchronous orbit)--good for day-to-day comparisons
- Measures "space weather" so we can prepare for intermittent service
- Limitation: only Black & White imagery

[SLIDE]

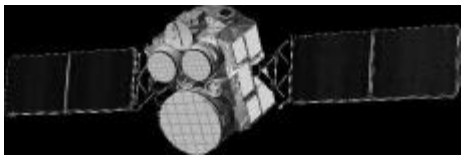


LOQ: WHAT DOES "GPS" STAND FOR? DESCRIBE THE SATELLITE. WHAT CAN IT DO?

AR:

- Global Positioning System
- 2 solar panels attached with the long side adjacent to central body
- Provides precise latitude, longitude, altitude, time, and velocity data
- Can also detect nuclear detonations
- Limitation: unfortunately, GPS signal can be jammed

[SLIDE]



LOQ: WHAT DOES "DSCS" STAND FOR? DESCRIBE THE SATELLITE. WHAT CAN IT DO?

AR:

- Defense Satellite Communication System
- 2 solar panels attached with the short side adjacent to central body
- Super High Frequency (SHF) communications --much more jam-resistant than UHF
- carries DSN telephone calls

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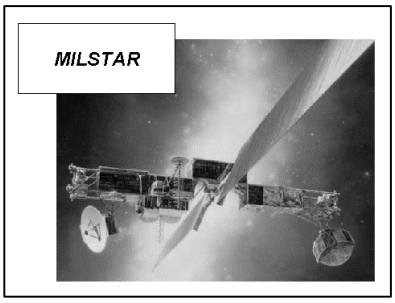
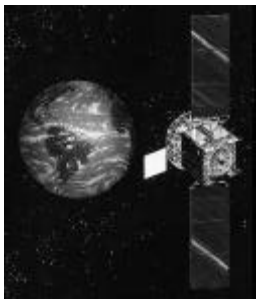


LOQ: WHAT IS "MILSTAR"? DESCRIBE THE SATELLITE. WHAT CAN IT DO?

AR:

- "MILSTAR" used to be an acronym, but now it has come to be the name of this communications relay satellite
- 2 extremely long rectangular solar panels--short side adjacent to main chassis
- Jam-resistant Extra High Frequency (EHF) communications
- Can crosslink transmissions from EHF to Ultra High Frequency (UHF)

[SLIDE]



LOQ: WHAT IS THE "UHF FOLLOW-ON"? DESCRIBE THE SATELLITE. WHAT CAN IT DO?

AR:

- Also called "UFO"
- 2 solar panels attached with short side next to main body
- White, square-shaped device projects from one side
- Navy's new 10-satellite constellation that provides global communications for all Services
- 39 UHF channels, also an EHF package
- Operational life of 14 years
- Can operate for 30 days without ground contact, if necessary
- Limitation: UHF signal is highly susceptible to jamming

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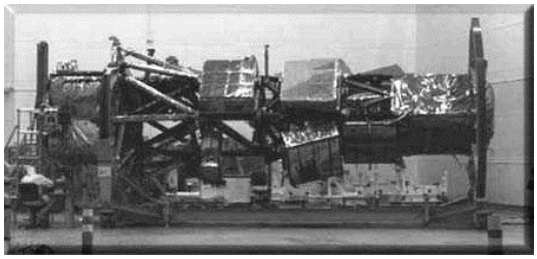


LOQ: WHAT ARE "NATIONAL SYSTEMS"? WHAT CAN THEY DO?

AR:

- "Spy satellites"
- Imagery Intelligence (IMINT): imagery collection, processing, production, and distribution
- Signals Intelligence (SIGINT)

- Limitation: Very expensive
- They can be employed in Molniya orbits (highly-inclined, highly elliptical orbits) to increase dwell-time over high-interest targets
- However, due to orbital limitations and expense, their coverage of high-interest targets is sometimes incomplete

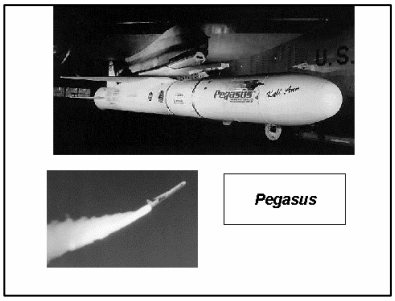
INTERIM SUMMARY (Instructor Note):

1. Include students' ideas that support main points.
2. Add new information as necessary.
3. Reinforce key elements that will be needed throughout the lesson.

(TRANSITION): NOW THAT WE'VE DISCUSSED SOME OF THE SATELLITE SYSTEMS, LET'S TALK ABOUT SOME OF OUR LAUNCH VEHICLES AND BALLISTIC MISSILES.

c. MP II: Launch Vehicles and Ballistic Missiles: 0:10 (0:40)

[SLIDE]



LOQ: DESCRIBE A "PEGASUS." WHAT CAN IT DO?

AR:

- A rocket with wings and tail surfaces
- Carried by a commercial aircraft
- Pegasus is used to launch scientific satellites
- 1,050 pounds to low earth orbit
- Limitation: All other launch systems carry heavier payloads

[SLIDE]

LOQ: DESCRIBE AN "ATLAS." WHAT CAN IT DO?

AR:

- Payload capsule is bigger than Delta's and smaller than Titan's
- Can launch DSCS and UHF Follow-On satellites
- Can employ Centaur upper stage booster (in payload capsule) to send satellites to geosynchronous orbit
- 14,500 pounds to low earth orbit
- 6,100 pounds to geosynchronous orbit

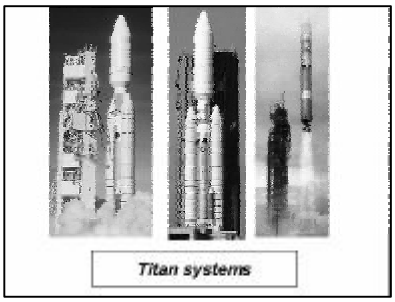
[SLIDE]

LOQ: DESCRIBE A "DELTA." WHAT CAN IT DO?

AR:

- Payload capsule is usually smaller than both Atlas' and Titan's
- 9 solid rocket boosters attached to the first stage (usually)
- launches GPS satellites
- 11,100 pounds to low earth orbit
- 8,420 pounds to polar low earth circular orbit
- 2,000 pounds to geosynchronous

[SLIDE]



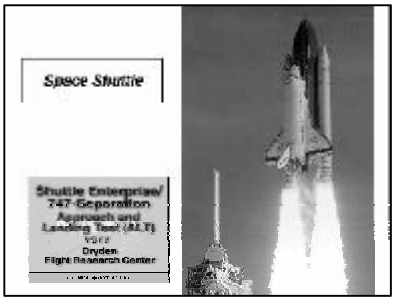
LOQ: DESCRIBE A "TITAN." WHAT CAN IT DO?

AR:

- Titan II doesn't have solid rocket boosters
- Titan II launches DMSP weather satellites
- Titan II: 4,200 lbs to polar low earth circular
- Titan IV has 2 large solid rocket boosters
- Titan IV is used to launch DSP and MILSTAR
- Can be launched with no upper stage, or with either Centaur upper stage booster or Inertial Upper Stage booster
- 47,800 pounds to low earth orbit
- 12,700 lbs. to geosynchronous

[SLIDE]

*{**Instructor Note:** There is an embedded video clip on this slide showing the shuttle* Enterprise *separating from the back of a 747 during landing tests. To start the clip, move the pointer over the clip on the slide and left-click.}*

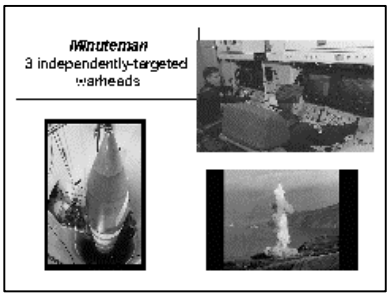


LOQ: WHAT CAN WE USE THE SPACE SHUTTLE TO DO?

AR:

- Our only operational re-useable launch system
- Can launch satellites like DSCS and DSP
- Limitation: Very expensive
- Seven Orbiters were built: (Note: "STA" = Structural Test Article; "OV" = Orbiter Vehicle)
  - PATHFINDER (STA-098): delivered as a full-scale mockup for structural testing at Marshall Space Flight Center, Huntsville, AL, and never saw operational flight
  - CHALLENGER (STA/OV-99): designated a test vehicle, but was later modified for space flight after engineers decided against converting the Enterprise, due to extensive vibration tests conducted on the Enterprise. Challenger was destroyed during launch on 28 January 1986, killing 7
  - ENTERPRISE (OV-101): designed to serve as a test vehicle; only saw "glider flight" and landing, after being released from the back of a 747
  - COLUMBIA (OV-102)
  - DISCOVERY (OV-103)
  - ATLANTIS (OV-104)
  - ENDEAVOUR (OV-105)
- Fast Facts:
  - 1972 - Shuttle becomes an official space program
  - 1976 - Enterprise, non-operational test orbiter, is delivered to NASA
  - 1977 - Maiden "glider flight" of Enterprise off the back of a Boeing 747
  - 1979 - First integrated engine test run
  - 1981 - First launch: 12 April 1981
  - 1986 - Challenger explosion: 28 January 1986

[SLIDE]



LOQ: DESCRIBE THE CAPABILITIES AND LIMITATIONS OF THE MINUTEMAN III.

AR:

- 3-stage internally-guided ballistic missile--first stage is wider than the rest.
- "Hot-launched": Ignition occurs in silo, missile flies out through its own flame & exhaust. Silo is destroyed and can't be reused.
- Can deliver 3 independently-targeted warheads with great accuracy.
- Can't be recalled (bombers can).
- Under the terms of the second Strategic Arms Reduction Treaty (START II), all Minuteman systems will be allowed to carry only one warhead.
- The AF plans to modify Minuteman missiles to a single Peacekeeper warhead when Peacekeeper is retired IAW the START II agreement.
- Maintenance is conducted at remote sites up to 150 miles from the main base and can be very dangerous.
- The Minuteman system has undergone continuous upgrade and refurbishment of missiles, launch facilities, and support equipment during its lifetime. The missile itself is currently being upgraded for guidance and propulsion.

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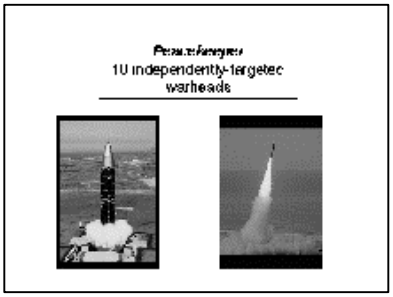


LOQ: DESCRIBE THE "PEACEKEEPER'S" CAPABILITIES AND LIMITATIONS.

AR:

- Can deliver 10 independently-targeted warheads with greater accuracy than any other missile.
- 4-stage internally-guidance ballistic missile-- all stages are the same width.
- "Cold-launched": Peacekeeper is forced out of its silo by steam pressure--Ignition occurs at an altitude of about 80 feet (unlike Minuteman).
- Cold-launch technique preserves silo--silo can be reused.
- Although cold-launch technique preserves the silo, assembling Peacekeeper in its silo is a difficult, time-consuming task due to the precision required.
- Protected inside its silo with nine rows of Teflon-coated polyurethane pads, which fall away after Peacekeeper is launched.

- Maintenance is conducted at remote sites up to 100 miles from the main base and can be very dangerous.
- Can't be recalled once launched (bombers can).
- Under the terms of the second Strategic Arms Reduction Treaty (START II), all Peacekeeper systems are scheduled to be deactivated.

INTERIM SUMMARY (Instructor Note):

1. Include students' ideas that support main points.
2. Add new information as necessary.
3. Reinforce key elements that will be needed throughout the lesson.

(TRANSITION): NOW THAT WE'VE DISCUSSED SPACE SYSTEMS, LET'S TALK ABOUT SOME OF OUR AIRCRAFT.

d. MP III: Aircraft: 0:45 (1:25)

*{**Instructor Note:** Throughout this main point, you can show students selections of the "Airpower Demos" videos (available on the LAN) to demonstrate these systems.}*

[SLIDE]

LOQ: DESCRIBE A KC-135. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Stratotanker"
- Based on Boeing 707 airframe
- 4 engines on wing pylons
- Refueling boom on underside of aft fuselage

- Can refuel Navy, Marine, NATO, and allied aircraft that use the drogue system, and (in the same mission) Air Force aircraft with boom--but only if fitted with wing hose-and-drogue pods
- Limitation: Without pods installed, can only fly with <u>either</u> drogue <u>or</u> boom
- 83,000 pounds cargo or up to 57 passengers
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]

LOQ: DESCRIBE A KC-10. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Extender"
- Based on DC-10 airframe
- 3 engines (2 on wings, 1 on tail)
- Fitted with <u>both</u> drogue <u>and</u> boom (see note in KC-135 section on drogue)
- Carries twice as much fuel as the KC-135
- 170,000 pounds cargo and up to 75 passengers
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]

LOQ: DESCRIBE A C-130. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Hercules"
- 4 turboprops (propellers driven by jet engines)
- Can use short, rough runways
- 45,000 lbs cargo or 92 passengers or 74 litters
- Limitation: Unarmed against fighters, easy to detect with radar, and slow--vulnerable to attack

FOLLOW-UP QUESTION (FUQ): DESCRIBE THE VARIANTS OF THE C-130. WHAT CAN THEY DO? WHAT ARE THEIR LIMITATIONS?

AR:

- Same limitations: Unarmed against fighters, easy to detect, and slow--vulnerable to attack
- WC-130--weather reconnaissance
- HC-130 is an extended-range Combat Search And Rescue (CSAR) variant. It can stay aloft 18 hours and air-refuel CSAR helicopters

[SLIDE]

- AC-130 "Gunship" can destroy targets with 40mm & 105mm cannons and machine guns

[SLIDE]

- MC-130E/H “Combat Talon” is equipped with terrain-following and terrain-avoidance radar--can transport & resupply special ops forces

[SLIDE]

- EC-130E “Commando Solo”--television and radio studio for psychological operations (PSYOPS)

[SLIDE]

- MC-130P “Combat Shadow” air-refuels special operations helicopters--flies mostly at night to reduce probability of detection and attack
- EC-130E “ABCCC” (Airborne Battlefield Command and Control Center)--that’s its job!
- EC-130H “Compass Call” jams and disrupts enemy communications

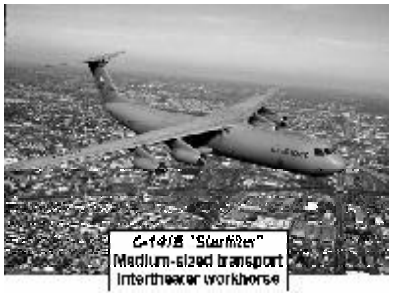
[SLIDE]

LOQ: DESCRIBE A C-5. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Galaxy"
- Largest DoD aircraft
- Entire nose section hinges open
- Can load and off-load simultaneously, since the nose & aft doors open to width / height of cargo area
- Can carry every piece of Army equipment
- 291,000 lbs cargo or 340 passengers
- Can air-drop up to 42,000 lbs
- Limitation: Long runway requirements
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]



LOQ: DESCRIBE A C-141. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Starlifter"
- Looks like a smaller, thinner C-5
- 69,000 lbs of cargo or 200 passengers
- 103 litters & 14 medical personnel
- Holds world record for cargo air drops: 70,195 lbs
- Limitation: Can't carry the heaviest items the C-5 can carry
- Limitation: aging airframe
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]

LOQ: DESCRIBE A C-17. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Globemaster III"
- AF's only transport with winglets on wingtips
- Can taxi in reverse, using thrust-reversing engines
- Uses short, narrow fields once restricted to C-130s
- 170,900 lbs of cargo or 102 passengers
- 48 litters & 54 medical personnel
- Can air-drop up to 60,000 pounds
- Limitation: Can't carry the heaviest items the C-5 can carry
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]

LOQ: DESCRIBE THE F-15 VARIANTS. WHAT CAN THEY DO? WHAT ARE THEIR LIMITATIONS?

AR:

- F-15C "Eagle" / F-15E "Strike Eagle"
- 2 parallel vertical "tails," perpendicular to wings

- No wingtip missile rails (F-16 & F/A-18 have them)
- F-15C has 1 seat / F-15E has 2 seats
- Both: good dogfighters, carry air-to-air missiles

[SLIDE]

- F-15E also carries air-to-surface weapons
- F-15E uses Low Altitude Navigation & Targeting Infrared for Night (LANTIRN) for low-altitude night attacks in bad weather
- Limitation: Enemy radar can detect F-15 easier than it can detect other fighters, due to F-15's size & shape

[SLIDE]

LOQ: DESCRIBE THE F-16 VARIANTS. WHAT CAN THEY DO? WHAT ARE THEIR LIMITATIONS?

AR:

- "Fighting Falcon"
- 1 vertical stabilizer ("tail")
- 1 engine with mouth-shaped inlet
- Multi-role--can attack both air & surface targets
- Both F-16C & F-16CJ use Low Altitude Navigation & Targeting Infrared for Night (LANTIRN) for low-altitude night attacks in bad weather

- F-16CJ is specially fitted to deploy High-speed Anti-Radiation Missiles (HARM) to attack enemy surface-to-air missile (SAM) sites: HARM homes in on SAM site's radar emissions
- Limitation: If the enemy turns off the ground radar, HARM loses its guidance (and can miss the target)
- Limitation: Short range and endurance--limited internal fuel

[SLIDE]

LOQ: DESCRIBE THE F/A-18 VARIANTS. WHAT CAN THEY DO? WHAT ARE THEIR LIMITATIONS?

AR:

- F/A-18C "Hornet" / F/A-18E "Super Hornet"
- 2 tails in a "V" shape (not parallel)
- Wingtip missile rails
- F/A-18C "Hornet" has round inlets
- F/A-18E "Super Hornet" has rectangular inlets
- Multi-role--can attack both air & surface targets
- Both use a Navy system similar to LANTIRN for low-altitudes night attacks in bad weather
- Both are specially fitted to deploy High-speed Anti-Radiation Missiles (HARM) to attack enemy surface-to-air missile (SAM) sites: HARM homes in on SAM site's radar emissions
- Limitation: If the enemy turns off the ground radar, HARM loses its guidance (and can miss the target)
- Limited range and endurance (F/A-18C's range is even less than the F-16's)

[SLIDE]

LOQ: DESCRIBE AN F-117. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Nighthawk"
- No external weapons or rails--this minimizes radar reflection (the F-22 and B-2 also have this feature)
- Engine inlets and nozzles are masked to minimize infrared signature (as are the B-2's)
- Straight leading edges
- Intersecting flat surfaces give the F-117 a uniquely angular shape
- Shaped to be as stealthy as possible--painted with special coatings, too (like the B-2)
- automated mission planning system & autopilot can be programmed to avoid threats
- Limitation: Not very maneuverable: Vulnerable to attack, if detected
- Limitation: Requires highly-detailed mission planning to avoid all potential threats
- Limitation: Can attack only at night
- Limited weapons bay space-- usually carries 2 bombs--2,000 pounds each

[SLIDE]

LOQ: DESCRIBE AN A-10. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Thunderbolt" ("Wart Hog," unofficially)
- 2 parallel "tails"--one on each end of a rectangle-shaped horizontal stabilizer
- 2 large engines on upper half of rear fuselage
- Large multi-barreled gun on the nose
- Can loiter over target up to 2 hours unrefueled
- Loiters & maneuvers better than F-16
- 30mm nose cannon can destroy tanks a mile away
- Can carry heat-seeking air-to-air missiles
- Can survive heavy ground fire
- Limitation: Can't carry radar-guided air-to-air missiles--can't destroy fighters beyond visual range
- Limitation: Vulnerable to attack by enemy fighters and ground fire, due to low top speed

[SLIDE]

LOQ: DESCRIBE AN EA-6B. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Prowler"
- Big pod on top of vertical stabilizer
- Non-retractable refueling probe in front of canopy
- Teardrop-shaped fuselage
- Supports all electronic countermeasures (ECM) and jamming missions DoD-wide after the Air Force removed the EF-111 from service

- Crew of 4: pilot and 3 ECM operators who manually operate jammers (EF-111 had crew of 2: one pilot and one Electronic Warfare Officer (EWO) to program computer-controlled jamming)
- Specially fitted to deploy High-speed Anti-Radiation Missiles (HARM) to attack enemy surface-to-air missile (SAM) sites and search radars which can't be effectively jammed: HARM homes in on site's radar emissions
- Can provide Zone ECM to suppress enemy air defenses, providing umbrella of protection over strike aircraft, ground troops, and ships by jamming enemy radar, electronic data links, and communications
- Limitation: Flies low and slow: Vulnerable to attack
- Limitation: Unable to destroy enemy fighters

[SLIDE]

LOQ: DESCRIBE A B-52. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Stratofortress" ("BUFF," unofficially)
- 8 engines--4 nacelles with 2 engines each
- Wide wingspan; swept-back wings
- Much longer unrefueled range than a B-1 or B-2
- Can carry weapons both internally and externally (on wing pylons)--can launch cruise missiles from these pylons at high altitudes, then descend and drop bombs at low altitudes
- Limitation: Size & shape are easy for enemy radar to detect
- Limitation: Requires a longer runway than B-1 & B-2 need
- Limitation: Unarmed and slow--vulnerable to attack
- Limitation: Increasing age & maintenance costs

[SLIDE]

LOQ: DESCRIBE A B-1. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Lancer"
- Swing-wing design: wings swept back at high speeds-- wings forward for low speed, take-off, and landing--wings in middle position for cruise
- Tapered, "coke-bottle" fuselage for reduced drag
- Our only supersonic heavy bomber
- Carries heavier weapons load than B-2 or B-52 can carry
- Can avoid enemy radar better than B-52 can
- Automatic terrain-following radar system
- Limitation: Very poor reliability and maintainability
- Limitation: Easier to detect than B-2--relies on a towed decoy for protection from radar-homing missiles
- Limitation: Unable to destroy enemy fighters--vulnerable to attack

[SLIDE]

LOQ: DESCRIBE A B-2. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Spirit"

- "Flying wing" design--no vertical stabilizer
- No external weapons or rails to minimize radar reflection (like F-117 & F-22)
- Engine inlets & nozzles are "masked" to minimize infrared signature (as are the F-117s)
- Straight leading edges and trailing edge segments which are parallel with each other
- Shaped to be as stealthy as possible--painted with special coatings (like the F-117)
- Requires fewer crewmembers (2 total) than B-1 (4 total) and B-52 (5 total)
- Limitation: Slow, compared to fighters, and not very maneuverable: vulnerable to attack, if detected
- Limitation: Very expensive aircraft: attacks planned during darkness to minimize vulnerabilities
- Limitation: Aircraft shelters at Whiteman AFB, MO, are large enough and specialized to house and protect the B-2, so B-2 typically doesn't deploy

[SLIDE]

LOQ: DESCRIBE AN E-3. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Sentry" (or, "AWACS")
- Large, rotating radar dome on top
- Airframe based on KC-135
- Can perform airborne surveillance, early warning, target identification and tracking, weapons control, air battle management, and communications functions for a wide area
- Can stay aloft for about 11 hours, unrefueled

- Can provide information needed for interdiction, reconnaissance, airlift, and close-air support for friendly ground forces; can also direct friendly fighters to intercept enemy aircraft
- Limitation: Unarmed and slow--vulnerable to attack

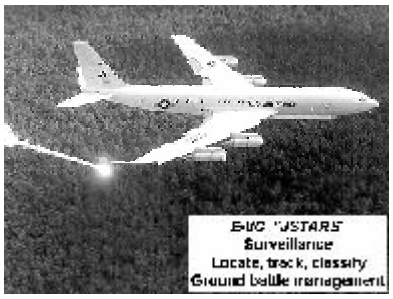
[SLIDE]

LOQ: DESCRIBE AN E-4. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "National Airborne Operations Center" (or, "NAOC")
- Airframe based on Boeing 747
- Teardrop-shaped radome on top
- National Airborne Operations Center (NAOC) for the National Command Authorities (NCA)
- Command, control, and communications center to direct US strategic forces and execute Emergency War Orders by the NCA in the event of national emergency or destruction of ground-based command and control centers
- Electromagnetic pulse (EMP) protection--can function in nuclear war conditions
- At least one E-4B and staff are always on alert
- Also supports the Federal Emergency Management Agency (FEMA) when a natural disaster occurs--E-4 flies response team to the disaster site and serves as the command and control center until the FEMA team can set up their own equipment: Cuts down response time
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]



LOQ: DESCRIBE AN E-8. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Joint STARS" (or, "JSTARS")
- 40-foot-long canoe-shaped radome under the forward fuselage
- Airframe based on KC-135
- Can locate, identify, and track enemy and friendly ground forces in all weather conditions
- Supports targeting and attack operations, including attack aviation and both naval & field artillery
- Radar can operate in several modes: wide area surveillance, moving target indicator, sector search, radar imagery, bomb damage assessment
- Can relay real-time information via a secure jam-resistant data link to the Army's mobile Ground Station Modules and AH-64D Apache Longbow attack helicopters
- Can stay aloft for about 11 hours, unrefueled
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]

LOQ: DESCRIBE A U-2. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Dragon Lady"
- Long, tube-shaped fuselage
- Long, unswept (straight) wings
- 1 engine, oval inlets on both sides of fuselage
- Can carry long, tube-shaped pods on each wing
- Extremely high altitude flight (+70,000 feet)
- Capable of unrefueled flight of over 14 hours--range of over 4,500 miles
- Can perform day and night, all-weather area surveillance and reconnaissance, including multi-sensor photography and electro-optic (that is, video), infrared, and radar imagery
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]

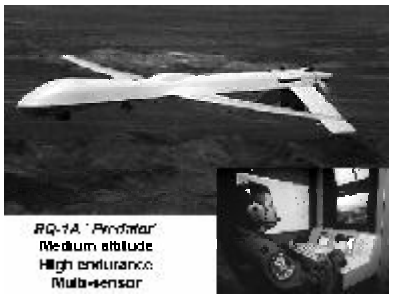
LOQ: DESCRIBE AN RC-135. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Cobra Ball" / "Combat Sent" / "Rivet Joint"
- Airframe based on KC-135
- Extended nose or tail radome
- Rectangular radomes on both sides of the forward fuselage
- Can perform highly-specialized reconnaissance
- "Rivet Joint" (RC-135V/W) can work with E-3 AWACS during combat to provide direct, near-real-time electronic warfare support & reconnaissance data to theater commanders and combat forces
- "Rivet Joint" also loiters near battlefields to provide data on enemy air defense systems to assist crews of F-16CJ aircraft with Suppression of Enemy Air Defense (SEAD) mission
- "Combat Sent" (RC-135U) can measure and analyze foreign electronic and infrared (IR) equipment

- "Cobra Ball" (RC-135S) can track missile launches with wide-area IR sensors, long-range optical telescopes, and advanced systems that can locate missile launch 250 miles away & calculate its impact point
- Limitation: Unarmed and slow--vulnerable to attack

[SLIDE]



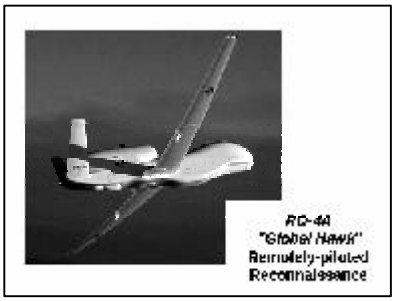
LOQ: DESCRIBE A "PREDATOR." WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- RQ-1A (designator)
- 2 rectangular tails in a downward-pointing "V"
- "Pusher" propeller behind the tail
- Teardrop-shaped forward fuselage
- Remotely piloted--no risk to crewmembers
- Can loiter 25,000 feet high (usually 10,000 to 15,000) at point 1,000 miles away (usually 500)
- Flies 80 mph & loiters far longer than U-2--can remain aloft 40 hours, & on-station over 24
- Carries a variety of equipment: electro-optical (for real-time video), infrared (to locate heat concentrations) and synthetic aperture radar (to see targets through clouds or foliage)
- Can transmit television-quality videos by satellite within 2 seconds to 34 military headquarters monitoring stations worldwide
- Can send real-time intelligence directly to cockpits to help aircrews prepare attacks
- Limitation: Not autonomous, like Global Hawk: Requires full-time hands-on flight control by ground crew
- Limitation: Predator's navigational coordinate system isn't precise enough to be used as a reference for targeting GPS-guided bombs--requires additional data

- Limitation: Vulnerable to enemy attack

[SLIDE]



LOQ: DESCRIBE A "GLOBAL HAWK." WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- RQ-4A (designator)
- 2 tails in upward-pointing "V" (unlike Predator)
- 1 jet engine & inlet on top of fuselage
- Whale-shaped forward fuselage
- Remotely piloted--no risk to crewmembers
- Can fly farther & nearly as high as U-2--loiters over 67,000 feet high at point 3,450 miles away
- Can fly 400 mph & loiter far longer than U-2--can remain aloft 40 hours, & on-station over 24
- Can fly autonomously from takeoff to landing--missions can be pre-programmed
- Can survey an area the size of Illinois (40,000 square miles)--larger area than E-8 can survey
- Radar can operate in several modes, providing wide area surveillance, radar imagery, moving target indicator (tracks targets as they move on the ground)--also uses infrared sensors & video
- Limitation: Vulnerable to enemy detection
- Limitation: Expensive: Test program has already exceeded projected costs

[SLIDE]

LOQ: DESCRIBE AN MH-60. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Pave Hawk"
- Non-retractable landing gear
- Horizontal stabilizer below the tail rotor--extends to both sides
- **"Black Hawk"** basic variant operated by the Army, has no refueling probe
- "Pave Hawk" has semi-retractable refueling probe
- Can perform combat search & rescue
- Follows terrain contours and avoids obstacles by using forward-looking infrared sensor, along with night vision goggles & cockpit displays
- Navigation equipment is data-linked to satellites
- Can detect enemy radar and missile threats and dispense chaff & flares (radar & heat-seeking missile countermeasures) in either automatic, semi-automatic, or manual modes
- 2 machine guns--either 7.62mm or .50 caliber
- Can lift 8,000 pounds with external cargo hook
- Can transport 11-14 troops or 6 litters
- Limitation: Can't perform electronic self-protection jamming against enemy radar

[SLIDE]

LOQ: DESCRIBE AN MH-53. WHAT CAN IT DO? WHAT ARE ITS LIMITATIONS?

AR:

- "Pave Low"
- Retractable landing gear
- Horizontal stabilizer near the tail rotor's center--extends only to right side (viewed from behind)
- Semi-retractable refueling probe
- Largest & most powerful helicopter in the Air Force
- Can perform undetected missions in enemy areas: combat search & rescue, transport & resupply of special operations forces
- Follows terrain contours and avoids obstacles by using terrain-following/terrain-avoidance radar and forward-looking infrared sensor
- Can perform some electronic self-protection jamming against enemy radar
- Can integrate on-board electronic warfare and jamming equipment with off-board computers and intelligence via satellite
- Can carry 3 machine guns--either 7.62mm or .50 caliber, or a combination of both
- Can lift 20,000 pounds with external cargo hook
- Can transport 38 troops or 14 litters
- Much longer unrefueled range than "Pave Hawk"

e. Conclusion: 0:05 (1:30)

1) //Summary//

We've covered a lot of systems in this lesson.

2) //Remotivation//

Throughout the course, as well as your career, you'll need to be familiar with these systems, and the new systems we develop. They're the tools of your trade. And you never know when a group of Girl Scouts or Boy Scouts (or a senior officer from another service on a Joint staff!) will pin you down with questions about YOUR Air Force!

3) //Closure//

Keep in mind that we orchestrate the employment of all of these systems--together. In A1220, we'll discuss the air and space power functions these systems perform, and in A1230, Force Packaging, we'll think about ways we could team these systems together to maximize the effect of their capabilities and minimize the impact of their limitations.